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ABSTRACT

Papers on science and technology libraries which were presented at the 1985 International Federation of Library Associations (IFLA) conference include: (1) "UAP (Universal Availability of Publications) and User Training for Categories of Grey Literature" (Dieter Schmidmaier, Mining Academy Freiberg, East Germany); (2) "Resource Sharing in Science and Technology Libraries in India" (S. K. Taneja, Department of Science and Technology, India); (3) "Information and Technology Transfer to Developing Countries" (James E. Beverly, U.S. Agency for International Development, United States); (4) "The Domesday Project: An Innovative Use of Optical Disc Technology by the British Broadcasting Corporation (BBC)" (Peter Armstrong, BBC-TV, United Kingdom); and (5) "Optical Disks--An Emerging Technology for Libraries" (William R. Nugent, Library of Congress, United States). (THC)

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UAP and User Training For Categories of Grey Literature

by

BR Dr. Dieter Schmidmaier

Mining Academy Freiberg/GDR

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Special Libraries Division
Science and Technology Libraries Section

UAP and user training for categories of grey literature

BR Dr. Dieter Schmidmaier
Mining Academy Freiberg/GDR
Standing Committee Member

UAP and user training for categories of grey literature

Dieter Schmidmaier

UAP[1] - an objective and a programme of the IFLA which enjoys the full support of UNESCO. The objective is the widest possible availability of published material. If we regard publication as something recording information issued for public use, it would include printed materials, audio-visual materials and electronically stored texts. And printed materials include grey literature: "Non-conventional publications, often called 'grey literature', are those that are not issued through the usual commercial publishing and distribution channels and therefore present particular difficulties in bibliographic control, acquisition and provision."[2] The generic term "grey literature" covers - allowing for differences between subject areas and the various views of different authors - the following categories of printed materials:[3 - 5]

1. Non-conventional scientific literature: p. e. conference literature, research and development bulletins, theses, patents
2. Non-conventional informational material: p. e. publications produced by governments, parliaments, public authorities, administrative bodies, agencies, institutions and charitable institutions (so-called official literature) as well as the publications of political parties, organisations, associations, co-operatives, companies, universities, libraries and museums (such as catalogues, bibliographies, journals, prospects, guides and university lecture programmes), statistics, standards, posters and leaflets
3. Conventional informational material: p. e. journals which do not contain original scientific contributions as well as newspapers and illustrated magazines, news and radio services, schoolbooks.

Grey literature must also be available.[6] Numerous national and international systems now take these important information sources.[7 - 8] The UAP covers all information sources of all

countries. Active co-operation in this project brings us closer to the ideal state of affairs, in which everyone always has unrestricted access to every publication regardless of when and where. Making the UAP programme popular with publishers, bookdealers and libraries, and with the government offices responsible for planning and financing publications, with users of information systems, libraries and information centres is important. A barrier to availability is "a lack of knowledge among users".[9] User training is an effective method of overcoming this barrier.

The relationship of the UAP to user training has already been stated several times and incorporated in the UAP programme.[10] Today the term user training is used world-wide to describe the systematic provision of knowledge, abilities and skills required in using libraries, information systems and information sources. Its content must be altered for the 1980's and -90's, in order that libraries and information facilities can meet the new demands placed on scientific communication. This is also valid for the relationship to "grey literature". The user is totally ignorant of the existence of numerous sources of information, apart from when he himself contributed to them through appraisal, translation, editorial work or lecturing. The higher the degree of education, or the age of the person is, the more frequent the use of a library, and the more intimate the knowledge of information systems the better the person's relationship to grey literature.

A point of emphasis of library work within the framework of the UAP is the introduction of advanced users - of users, therefore, who have already acquired a basic knowledge through user training - to the availability of grey literature. This introduction can be

1. to information systems which predominantly offer grey literature
2. to bibliographies and abstract journals, which list grey literature

3. into individual categories of grey literature.

Using examples of individual categories methods, content, forms of organisation and problems can be presented to the last point:

1. Regulations on the standardisation and the availability of standards
2. Inventions and the availability of patents
3. Advertising by firms and the availability of business documents
4. The results of geological and geographical investigations and the availability of maps
5. Government documents and the availability of official publications
6. Conferences, symposiums, colloquiums and conferences and the availability of conference literature.

STANDARDS

I would like to treat forms of user training involving standards exclusively on the basis of experience gained in the GDR. Due to a new regulation in 1984 and other legislations from 1979 to 1984 the importance of standards as an information source has continued to grow. Standards must be on inherent component of all forms of user training, but the extent of the knowledge provided depends on the people being instructed.

Standardisation is no longer indispensable just for technical disciplines, but is involving more and more subjects and affects every citizen every day.

The student comes into contact with standards at a late stage of his studies. Therefore, a detailed presentation of these sources of information is out of place in the first phase of user training in the first year of studies. On the contrary: the student should not receive at too early a stage too much

3

information about services offered by a library and information centres as well as about information sources, which he cannot yet use or does not yet require. At this stage he is not able to grasp the importance of these sources for scientific work. For this reason the provision of a knowledge of standardisation is very important in the second phase of user training, i e. mostly at the end of the second year of studies and in the third and fourth years. Four possibilities present themselves:

A) The inclusion of standardisation in lectures, seminars and exercises on the subject "Special information sources - special libraries - special information" (with parity given to other information sources typical for each scientific discipline)

B) An introduction to standardisation and the availability of standards as a separate lesson and thereby as a specific complement to other measures undertaken in user training e. g. within the framework of the time apportioned to university lecturers for their lessons

C) The integration of standardisation in the lectures, practical courses and exercises as well as special literature of university lecturers as a constituent part and necessary basis of each special scientific field

D) Giving enough attention to standardisation and the availability of standards in guides to the literature[11] and in other library and information publications intended for use by students.

At the moment method B) is undergoing successful trials at the Mining Academy Freiberg.

PATENTS

In regard to this matter I will also make reference to the experiences of the GDR. In 1983 the Council of State of the GDR passed a new law on patents, which does justice to the requirements of legal protection for inventions made as a part of pro-

4

gress in science and technology. It must be stated worldwide that patents are not given enough attention by scientists. Lectures held at the 49th and 50th IFLA General Conference pointed this out in an impressive manner.[12] Literature providing legal protection, in the sense used here predominantly patents, grows to the extent of 1 million per year, the so-called non-patent literature (books, reports, contributions to journals) by 2 million, but: only less than 10 % of the contents of patents are republished in the non-patent literature.

In the GDR much effort has been made to create the preconditions for a rapid and correct use of patents:

1. As early as 1957 courses were started at the Humboldt University on which specialists in patents were trained.[13]
2. From 1970 onwards the system of information and documentation was expanded, polytechnical patent libraries were established in several states.[14]
3. The tasks of universities and other establishments of higher education in patent rights and activity were discussed at two central conferences.[15]

The tasks of providing the student of engineering and students of some scientific disciplines with knowledge, abilities and skills in the use of patents derive from the last point:

1. The student should be provided with the basic knowledge required for adopting an approach to work suited to an engineer, especially the basic prerequisites for inventing.
2. The student should be provided with knowledge about the availability of patents, especially in the use of patent classification so that they are able to carry out studies of patents.
3. The graduate should possess knowledge about achieving research results without defects of title.

The axiom that exhaustive expositions of these information sources do <u>not</u> belong to the first phase of user training in the first year of studies is also valid here. The student has

no idea of the importance of work with patents at this stage, and will not have been confronted with studies of patents. This does not happen umtil the 3rd and 4th years of study. The four possibilities dealt with under the section STANDARDS are also in principle valid in this case, with the clear qualification, however, that practical work is focussed on i. e. research in the polytechnical patent libraries. In this connection positive experiences have been made at the Mining Academy in the Departments of Geotechnics/Mining and Chemistry.

Concerning the future a combination of different methods tried out at the School of Librarianship and Information Studies in Newcastle upon Tyne Polytechnic, U. K. is gaining in importance.[16] This is an initiative in training to use patents. Two institutions prepare a collection of training packages in patent information and documentation. These are

1. Videotapes (p. e. "Inventing the patent")
2. Tape/slide programmes (p. e. "Patent documents")
3. Online instructional computer program
4. Illustrated 1-hour lecture
5. Student's handbook
6. Instructor's handbook.

These packages can be used in any combination which is thought to be beneficial. Each is complete in itself. Two groups of people use the packages:

1. The instructors who will use them to mount courses
2. The recipients of the instruction who will attend the courses.

In 1983 a 72 hour course was presented in the soviet literature[17], in which a comprehensive knowledge in a single discipline "Introduction to Patents" is provided in 48 hours of lessons and 24 hours of practical work. The participants are students of the fifth year, who have already attended courses such as "Information Systems" and "Theory and Practice of Scientific and Technical Information".

BUSINESS DOCUMENTS

Standards and patents belong to the known and recognised information sources, whose contents are often known to the user, they just do not know how to get hold of these sources. Much less known and often not given recognition are documents published by firms. As far as I know there are no forms of user training which deal with this source comprehensively and properly. In guides to the literature now and again we find passages on business documents in context with other information sources.

The problem "business document" begins really in fact much earlier, namely in the special literature of librarianship. A contribution from 1967 by I. J. Haberer is still considered to be one of the rare publications worth reading.[18] Theoretical contributions from the ČSSR, Bulgaria, the USA and Great Britain from 1975 - 1981[19] were excellent, but it was M. J. Thomson who first presented a summary about forms, use and the value of business documents.[20] Extensive preparation is therefore needed before one attempts to inform oneself about aspects of business documents in user training. Experience has shown the following approaches to be useful:

A) An introduction to the information source business documents as a seperate, special course of instruction for students in their final year (before the dissertation) and for young scientists preparing themselves for tasks in research and teaching as well as higher academic qualifications.

B) The treatment of business documents in guides to the literature as an information source of equal importance when compared to others.

MAPS

In the last few years the increasing preoccupation with categories of grey literature of the geosciences[21] as a result of the

7

effect of the problems with raw materials has been remarkable; the IFLA 1984 General Conference was also affected by this.[22] If one examines map librarianship and map libraries as well as the Geography and Map Division Bulletin then a seperate map room orientation or library instruction in a map library would appear to be the answer. In the 559 entries of a map librarianship bibliography 1921 - 1973[23] one can find beginnings in this field. In 1974 the first meaningful article with a suggested course of instruction[24] appeared, since then contributions sporadically have appeared, but hardly more than 10 are registered in Library and information Science Abstracts.[25] On the basis of these experiences and the author's own experience at a mining and metallurgical university it can be concluded that students of geography and geosciences must obtain a timely introduction to the grey literature of their scientific discipline. Maps are, next to atlases and globes, the most important category. This can take place as

A) an introduction to maps as a separate special course of instruction for students as early as the second year onwards (before the first study trips) in close connection with a visit to map collections

B) the integration of the above-mentioned problems in the lectures, practical courses and exercises of university teachers on their courses as a constituent part and necessary basis of geography and geosciences

C) the treatment of maps in guides to the literature as an equal information source amongst others.[26]

OFFICIAL PUBLICATIONS

Official publications have been neglected to a great extent in user training. These are publications issued by central or regional organs of state including their subordinate organisations, by statutory corporations, public institutions, autonomous bodies, charities, parliaments and cooperatives. They serve an administrative purpose i. e. the administration and in-

8

terpretation of legislation, they convey information and serve to exercise influence on public opinion. They appear in and as books, newspapers, journals, periodicals and series e. g. official information booklets, parliamentary handbooks, pocket- and yearbooks of authorities, Festschriften, memorial publications, statistics, budgets, law gazettes, instructional pamphlets, forms, statutes, posters, leaflets. They possess great importance in the politics, business, science, technology and culture of each country, they reflect their will and work. They represent for the students of many fields an important source for learning and research.

For this reason it is necessary to convey knowledge, abilities and skills in the use of official publications.[27] This can take place through

A) the inclusion of official publications in lectures, seminars and exercises on the theme "special information source - special library - special information"

B) an introduction to the availability of official publications as a separate course of instruction for students of scientific disciplines who often have to work with official publications

C) the treatment of official publications in guides to the literature as an equal information source alongside others.

CONFERENCE LITERATURE

The number of users of libraries and information centres who chase after information on a conference and often remain unsuccessful in their efforts is constantly increasing. Conference literature is almost becoming an annoyance in scientific work because tracking it down, gathering it, the bibliographic description of it and storing it - in short: its availability - is becoming an increasing problem. Conferences, which are rapidly increasing in number and extent in most scientific disciplines, are producing numerous categories of information sources

9

which are becoming increasingly rare in bookshops and as monographies. The publication of the results of conference work hidden in journals, as preprints, as official publications, as reports, edited by organisations and congress centres is becoming the norm. Many difficulties are already mounting up behind the scenes of the libraries: from unitary bibliographic identifying[28] to a timely identification of all forms of conference literature[29]. All the authors agree on only thing: conference literature is one of the most important information sources for scientific progress, and the first articles on this from 1962[30] are - regarding statements on this matter - still valid today, newer material confirms this and looks for ways out of the difficult situations.[31]

If such problems already exist "behind the scenes", then what must it be like for the layman and user of information?

For the above-mentioned reasons user training is urgently required. It can only be carried out in close connection with scientific communication because this information source is linked directly to a form of communication in a way no other is. In such a process the attention of the users, who are participants and/or organisers of conferences, must be drawn to their responsibility to adhere to standard editorial practices and to punctually deliver conference reports. As with the preceding types of information sources the user only begins to use conference literature at an advanced stage. For this reason the following can be recommended:

A) the inclusion of the information source conference literature in lectures, seminars and exercises on the theme "special information source - special library - special information"

B) an introduction to the information source conference literature specially organised for participants of conferences

C) the treatment of conference literature in guides to the literature as an equal information source alongside others.

IN CONCLUSION

The examples given in the paper of six forms of grey literature in reference to user training show:

1. The student requires comprehensive information in the second, the productive phase of his studies, on information sources which do not appear in bookshops and which traditional have not been known to him.
2. Grey literature should not be offered to the student in an indiscriminate manner because the categories vary from one scientific discipline to another.
3. Different forms of conveying knowledge, abilities and skills are crystallising which differ fundamentally from other introductions: work in small groups even the one-to-one method in the information office and not mass lecturing with many students predominates in user training.
4. The UAP-programme cannot be realised if the user of information sources is not introduced to these information sources in a sensible manner.

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14

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15

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Resource Sharing in Science & Technology Libraries in India

by

S. K. Taneja

Senior Documentation Officer

Department of Science and Technology

Technology Bhavan

New Delhi

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RESOURCE SHARING IN SCIENCE & TECHNOLOGY LIBRARIES IN INDIA

By

S.K. TANEJA *

A B S T R A C T

Library resources in the context of present paper have been explained. Present status of resource sharing andits need as well as points against it in science and technology libraries have been mentioned. A special mention has been made of the role of INSDOC. Appropriate communication technology and tools required for resource sharing in libraries have been narrated and their creation and updating has been stressed for effective resource sharing. Objectives, structure, present and proposed sectoral information centres and future plans of National Information System for Science & Technology in India have been described. Mechanism of Resource Sharing has been suggested.

---

* S.K. TANEJA - Senior Documentation Officer
Department of Science & Technology,
Technology Bhavan,
New Mehrauli Road,
New Delhi-110 016.

* Views expressed in this paper are those of the author.

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C o n t e n t s

	Subject	Page No.
0	INTRODUCTION	1
0.1	Library Resources	1
1.	WHY RESOURCE SHARING	2
2.	POINTS AGAINST RESOURCE SHARING	3
3.	PRESENT STATUS	4
3.1	Role of INSDOC	4
3.2	Inter-Library Loan in Delhi	6
4.	NATIONAL INFORMATION SYSTEM FOR SCIENCE AND TECHNOLOGY (NISSAT)	6
4.1	NISSAT Objectives	7
4.2	Structure of NISSAT	8
4.3	Present & proposed Sectoral Information Centres	8
4.4	Future Plans of NISSAT	9
5.	COMMUNICATION TECHNOLOGY	9
6.	RESOURCE SHARING TOOLS	10
7.	MECHANISM OF RESOURCE SHARING	11
8.	CONCLUSION	14
9.	ACKNOWLEDGEMENTS	15
R E F E R E N C E S		16
A N N E X U R E - I		17
A N N E X U R E - II		18

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RESOURCE SHARING IN SCIENCE & TECHNOLOGY LIBRARIES IN INDIA

0 Introduction

Need to share resources is probably as old as libraries themselves. There is evidence that libraries of science and technology in India have been sharing books, journals and other reading material for the benefit of their respective clientele. The aim of libraries and hope of scholars has been to amass all the resources for research in the concerned discipline in a single library. This doctrine of self-sufficiency had to be given up finally because of the almost impossibility for any library to provide all resources for research required by its readers. Accordingly, a sharing of holdings among libraries is increasingly accepted as a necessity and as the only realistic means of providing all the resources needed for research.

0.1 Library Resources

The term 'Library Resources' for the purpose of this paper includes all materials, functions, professional expertise and services covered by a modern library. The term materials means all information bearing sources viz.printed material including grey literature which is difficult to locate due to its non-availability through book-trade channels but contains very useful information along with non-conventional items such as microforms, audio cassettes, films and machine readable databases, etc. The term functions describe the various library activities such as purchase, processing, indexing, organisation, storing and retrieval of the concerned information as and when required. Professional expertise means the personnel having wide experience and academic background in various library activities such as design of library building, setting-up a new library including reprographic facilities, manpower planning, documentation services

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and computerisation of library activities and information services etc. Here services connote all those library activities which match the information available in the library with the user needs, thereby promoting the use of information available in the Library.

1. Why Resource Sharing?

Prices of books, journals and other material etc. have been increasing constantly besides, growth in the number of publications, popularly known as information explosion or literature explosion. Annual subscription to journals has been rapidly increasing at a rate of 15% to 20%. As an example, ~~scientific and technical~~ percentage increase in cost of a few scientific and technical journals has been shown in Annexure-I.

In the field of science and technology alone, there is an annual output of 1,50,000 books, 2,00,000 reports and patent literature and over 3,000,000 articles published in various journals and conference proceedings thoughout the world. The number of scientific journals and articles therein are now doubling every 15 years.

According to ASLIB survey, the number of learned and scientific periodicals at the beginning of the 19th century was 100. It reached 1000 by 1885, 10,000 in 1900 and approached 1,00,000 in 1960. With this rate of growth their number would reach a million mark at the end of this century.

Increase in number of publications in any field of science and technology necessitates more funds for its acquisition and valuable space for orgmised storage in libraries. In India, or for that matter in any developing country, the number of scientific and technical publications imported from the developed countries is quite large. It

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is obvious from the fact that in most of the libraries/ information centres in India, proportion of foreign journals varies from 75% to 90% which consumed the major chunk of the budget of libraries. It is simply because developed countries are much ahead of developing countries in science and technology. Therefore, in order to keep pace with them in science and technology, scientific community in India ought to know about the latest developments elsewhere. Instead of obtaining multiple copies of any title in the same city, this objective can be better served through resource sharing which alone can ensure access to more literature or information services to library users without increasing pressure on the budget and space etc. under existing conditions.

2. Points against Resource Sharing

Some of the defects implied in resource sharing in libraries which go against it are enumerated below : -

1. If resource sharing mechanism fails at some stage, either due to technical or administrative reasons, concerned libraries in the network would be left far behind in their collection.
2. The cost of obtaining the material through resource sharing, at times, may be equal to or exceed the cost of material itself.
3. The large libraries may have to lend more material to others in the network. It would, therefore, be a source of drain instead of additional material for them.
4. Reource sharing would affect the economies of publishers to a certain extent, who may resort to increase in price to compensate for their loss due to decline in library orders.
5. Last, but not the least, if all libraries turn to resource sharing, none of the libraries in the resource sharing network will have books to lend to others.

3. Present Status

Libraries in India in Science and Technology at present group together to share their resources mostly limited to inter-library loan of books/journals etc. This service is generally confined to local level viz. libraries located in the same city and in a few cases to libraries located in different parts of India.

3.1 Role of INSDOC

INSDOC, as a National Documentation Centre supplies copies of articles from journals against demand from various libraries in India. INSDOC has been providing this service by obtaining most of the publications on inter-library loan from various libraries in the country and also from foreign sources such as British Library Lending Division, Boston Spa, UK etc.

INSDOC used to handle about 20,000 such requests per annum upto 1974, after which this number declined to about 11,000 per annum due to steep rise in the tariff. Even in 1978, the rate of requests had been at 1974 level.

In 1982-83, INSDOC serviced about 21,561 document copy supply orders. 73% of these demands were handled by the centre located at

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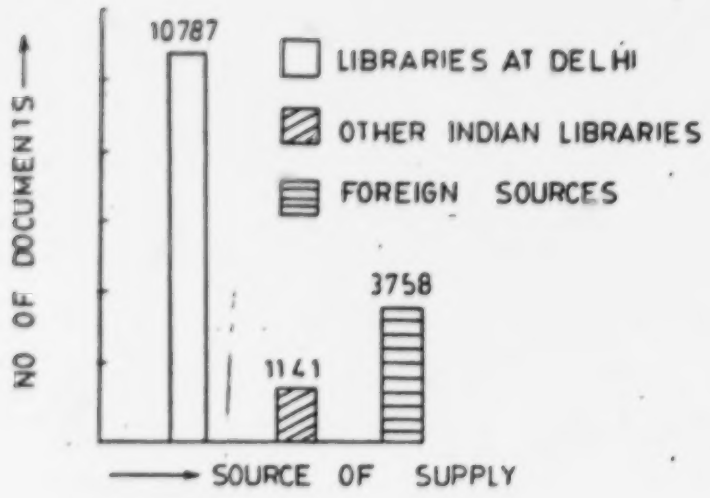
New Delhi, 19% by the centre at Bangalore and balance by its regional centres at Calcutta and Madras respectively.

Quantitative data regarding sources from where documents were obtained on inter-library loan for document supply service by the centre at New Delhi are indicated in the bar diagram below : -



3.2 Inter-Library Loan in Delhi

DST Library has been operating ILL with more than a dozen libraries of Delhi. It has ~~now~~ borrowed more publications than its lending. A survey of a few libraries in Delhi regarding ILL has been carried out. Data collected from various libraries indicated that National Physical Laboratory (NPL), Indian Institute of Technology (IIT) and All India Institute of Medical Sciences have lent more than they borrowed, whereas it is reverse in case of Central Road Research Institute (CRRI) and Planning Commission. This may be due to : -

(a) Large collection in their specialized areas of interest as well as huge budget of the lending libraries.

(b) Borrowing library serving the organisation whose areas of interest are so diverse that it cannot acquire all the requisite publications inspite of its reasonably sufficient budget.

4. National Information System for Science & Technology(NISSA

In India, with such vast area, attempts to disseminate information by many centres are sporadic. A look at the existing facilities in the country for industrial information and documentation will reveal several levels which will have to be coordinated by a national information system. Building of a strong national information infrastructure would enable us to take full use of the world science information system (UNISIST).

Government of India constituted in 1971 a high level committee called National Committee on Science & Technology (NCST) to advise in organising and planning science and technology for the country. During the year 1973, the NCST prepared for the first time, an overall science and technology plan for India (1974-79) as a part of the socio-economic 5th Five Year Plan. The plan was in 24 sectors with a view to study each sector critically and to evolve suitable programmes ~~for~~ of research, development and design for attaining

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time bound programmes. Information is one of the 24 sectors considered in the plan.

Accepting the premise that scientific and technical information plays very vital role in industrial and technological progress of a country, the NCST in India, recommended to the Government of India for the establishment of a National Information System for Science and Technology (NISSAT). The Government of India approved in May 1977 the NCST recommendation and established the NISSAT under the Department of Science and Technology.

4.1 NISSAT Objectives

The NISSAT project aims to achieve the following objectives :

(a) Provision of national information service relevant to present needs and capable of development to meet the future needs of the generators, processors, disseminators and users of information;

(b) Optimum utilisation of existing information services and systems and the development of new ones;

(c) Promotion of national and international cooperation and licensing for exchange of information;

(d) Support and active encouragement for the development of facilities for education and training in information science and technology, and in communication to provide qualified manpower for the implementation of the national science, information policy;

(e) Support of, and active participation in research, development and innovation in, information science & communication to enhance both the efficiency of information services and, the quality of the information provided by these services; and

(f) Support and promotion of research, development and innovation in information technology.

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4.2 Structure of NISSAT

The main components of NISSAT are : -

(1) The NISSAT National Focal Point in the Department of Science and Technology;

(2) The NISSAT Network of Services.

The NISSAT National Focal Point is advised and guided by the NISSAT Advisory Committee, the Executive Committee and Ad hoc Working Groups and Experts Groups and serviced by a small secretariat of professionals and experts. The NISSAT National Focal Point in the DST also functions as the point of interaction with UNESCO's General Information Programme.

The NISSAT Network consists of : -

(1) The Sectoral Information Centres on different sectors based on disciplines, products, missions etc. and their local information units;

(2) The Regional System comprising of Regional Centres; and

(3) Other specialised supporting services.

4.3 Present and Proposed Sectoral Information Centres

NISSAT has set-up the sectoral information centres(SICs) to provide grassroots base for the national information system in various sectors like food, drugs and pharmaceuticals, leather, machine tools, crystallography, etc. These SICs have been located in institutions of national and international repute which have displayed considerable degree of information handling capacity. NISSAT is in substance, a decentralised, distributed network consisting of information centres based on subject or discipline-orientation.

The NISSAT project can rightly be said to be in its infancy. It is proposed to launch 5 more sectoral centres during the coming years in the important areas - (1) small industries, (2) textiles, (3) chemicals, (4) minerals, (5) aeronautics. Areas such as roads, oceano-

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graphy, medicinal plants, tea, rubber, jute, petro-chemicals, glass and ceremics, wood, etc. would be given adequate emphasis in due course of time.

It is xproposed to equip the existing SICs with computers and gradually develop computerised information systems. A plan is also under way to link one of the regional centres to sectoral centre by means of existing telecommunication channels for exchange of documents and information between the two.

4.4 Future Plans of NISSAT

The NISSAT scheme is of vast and diverse dimensions, meant to cover the growing information needs of the large scientific and technical community of the entire Indian subcontinent. It has to serve over 1.3 million scientific and technical personnel. It has to coordinate and integrate the activities of more than 800 scientific and technical information centres and libraries operating under a variety of ownerships and jurisdictions, to form the NISSAT network. Use of modern information and telecommunication technologies will have to be introduced keeping in view the adaptation of technology to suit local conditions. During the coming years, the main focus of attention would be in developing the sectoral system, the regional system and some of the important central services.

5. Communication Technology

Rapid information storage, information processing and information transfer technology presently available can facilitate sharing of library resources. Essential facilities such as telex and telephone etc. with dedicated lines should be available with almost all participating libraries for communication.

The effectiveness of resource sharing depends on the availability of appropriate communication technology and supply of required material. Some of the facilities which can be easily made available under the existing conditions are dedicated telex and telephone lines for libraries. Com-

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puter, being an effective device for processing and locating the required materials rapidly irrespective of distance shoul be used for resource sharing. Selection of appropriate commu nication technology for resource sharing may be decided in terms of four major issues viz. 1) technical feasibility, 2) operational feasibility, 3) management feasibility, and 4) economic feasibility.

6. Resource Sharing Tools

In order to share the resources among libraries at local, regional or national level, availability of information about resources to be shared of all participating libraries is essential. For instance, in case of periodicals, a union catalogue of periodicals would be required. It has to be compiled and regularly updated based on the addition or deletion of titles received by the concerned libraries. It can be possible through fulfledged cooperation of all participating libraries.

INSDOC has compiled union catalogue of scientific serials of libraries (Annexure-II). However, due to apparent problems in compilation of such publications, INSDOC has not been able to maintain the union catalogue of scientific serials up-to-date. Computerisation of union catalogue and the cooperation of all the participating institutions would be helpful in keeping it up-to-date.

Similarly, union catalogue of books, technical reports, patents, conference proceedings etc. available in science & technology libraries may be compiled to enlarge the sphere of sharing of library material.

A Directory of Experts indicating their name, place of work, area of specialisation, telephone number, telex number etc. may be compiled to assist the libraries confronted with the problems such as (i) library building design (ii) type of documentation services to be started, (iii) suitable equipment, (iv) manpower requirement

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(v) computerisation of information services, etc.

Directory of modern equipment for information handling held by various libraries in the country, indicating make, cost, manufactures, suppliers, etc. alongwith experience/ evaluation of each equipment of user library are essential for benefit of libraries intending to acquire similar equipment.

All of us are aware that with the information explosion, it is not possible to handle vast amount of available information manually with speed and efficiency. Moreover, with the advent of modern information technology viz., computers, a few libraries have gained expertise in computerisation in of some of the library functions and generation of bibliographical databases for information storage and retrieval. Many more libraries are keen on application of computer to various functions. It would be worthwhile compiling a directory of such libraries in India to enable the interested libraries to share their expertise on mutually agreed terms and conditions. This would facilitate any library interested in computerisation of library functions and information services to get in touch with the library with requisite expertise for using their expertise already gained some where in the country instead of sharting afresh from a scrap.

7. Mechanism of Resource Sharing

In order to ensure the smooth functioning of resource sharing system, it is essential that ~~libraries of~~ the concerned libraries should have an open discussion on terms and conditions for its operation. A seminar on resource sharing may be quite appropriate forum for finalising modus operandi.

In the first instance, we shall consider sharing of a basic resource of a library viz. materials. Following terms/conditions are worthwhile for consideration of designing the mechanism : -

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1. Books, journals or other publications including reference material, frequently required by regular users of any holding library should not be shared.

2. Only that material, whose absence from library for short duration does not hamper the service rendered by a library to its users may be shared. However, period of issue of such material should be reasonably small, say, one to two weeks, so that the publications are available in the holding library for most of the time for use by its regular clientele as well as for sharing with any other library. This stipulated period once agreed to, should be strictly adhered to, by the borrowing library so that advantages of resource sharing may reach more libraries. Borrowed books should be returned as and when demanded by the lending library.

3. A rational fee structure should be worked out to compensate for the disadvantage of major libraries, being lender in most cases of resource sharing. This would provide financial support and encouragement to the concerned libraries to ensure the availability of more material for sharing.

4. Acquisition policy of the participating libraries should be clearly stated for balanced development of holdings for resource sharing. Lists of books selected for acquisition as well as accession list of each library in the resource sharing system should be invariably circulated to all the participating libraries. This would benefit the other concerned libraries in the system in deciding whether to acquire the same books or share them with the library acquiring them, depending upon the frequency of use and their geographical proximity.

5. Bibliographical control of holdings of the partners with predetermined standard format is essential to ensure compatibility and consistency for ~~xhjxx~~ effective

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resource sharing among the concerned libraries. In this connection, special attention should be paid towards the grey literature.

6. Transport facilities for efficient and effective operation of resources sharing should be made available at local level.

7. Inter-Library Loan among the libraries located in different parts of the country may be operated more efficiently by supplying microfilms/microfiches or xerox copy of the concerned documents, if technically and economically feasible. This would reduce the paper work and postal expenses and would also ensure the availability of documents for others.

8. Most of the libraries face the problem of missing issues of the journals despite follow-up action with the respective publishers/suppliers. This problem may be sorted out to an extent if all the libraries deposit the duplicate issues of journals received in certain cases with one agency. Any library wanting a specific issue may get in touch with that agency for obtaining the missing issues in case of availability and thus complete the sets.

Such a mechanism can be efficiently and effectively introduced through financial assistance under NISSAT. National Information Centres in the areas of drugs, leather, food sciences and technology, machine tools and crystallography have already been identified and their resources are being regularly augmented through financial support under NISSAT.

Similarly, more information centres may also be identified for financial support by NISSAT for a limited period for developing an effective resource sharing system in India.

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Once these centres at various levels of operation are set-up with or without financial support from NISSAT, responsibility of compilation of union catalogues and directories, etc. - essential tools for resource sharing - can be assigned subject to the availability of required facilities. Information for such tools may be collected by centres at local level and regional level and ultimate responsibility of consolidation of data collected at various levels and bringing out the concerned tools may be entrusted to National Information Centres.

8. C_o_n_c_l_u_s_i_o_n

The concept of resource sharing has been with us since long, but the existing conditions have made it more imperative. With escalating cost and tremendous growth rate of literature and scattering of information and limited library budget, it is not possible for any library to acquire all the available literature in any discipline. In order to render effective service to users with the available resources in India, we have to resort to resource sharing. However, any Resource Sharing System can function effectively only if the participating libraries have resources to share and willingness to share them. For the success of resource sharing system among the participating libraries pertaining to science and technology in India, there is a need for special effort and involvement of NISSAT for creation of common facilities such as transport, compilation of directories of consultants and details about the libraries using the modern information technology and union catalogues of books, journals, technical reports, grey literature, etc. held by the participating libraries.

In future, libraries shall have to resort to effective resource sharing with the changing concept of libraries and prohibitive cost of self-sufficiency. Some of the libraries in Indiahave started using computer for some of the functions. By using computer in combination with appropriate communication technology, time and distance constraints in free-flow

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of information from one library to another may be eliminated. All these developments would help us to evolve effective programme of sharing our resources, viz. materials, functions, expertise, manpower and services, etc. for achievement of ultimate objectives.

9. Acknowledgements

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Annexure-I

Escalation in cost of Publications

Sl. No.	Title (a)	Annual Subscription 1971-72 (b)	1983 (c)	Percentage Increase of (c) over (b)
1.	A I A A Journal	$ 60.00	$ 130.00	216
2.	Analytical Chemistry	$ 7.00	$ 18.00	257
3.	British Medical Journal	$ 24.00	$ 100.00	416
4.	British Technology Index (Title changed to Current Technology Index)	$ 65.00	$ 541.00	832
5.	Chemical Abstracts	$1950.00	$6200.00	317
6.	Computer Reviews	$ 25.00	$ 175.00	700
7.	Cybernetics	$ 115.00	$ 395.00	343
8.	Engineering (Eng.)	$ 20.00	$ 60.00	300
9.	Engineering Index Monthly and Author Index	$ 400.00	$1265.00	316
10.	Journal of Physics B:Atomic & Molecular Physics	$ 67.20	$ 625.00	930
11.	Laser Focus (Present Title : Laser Focus with Fiber Optic Technology	$ 24.00	$ 42.00	175
12.	Metal Progress	$ 9.00	$ 30.00	333
13.	Nature	$ 108.00	$ 173.00	160
14.	Physics Abstracts (Science Abstracts. Section A)	$ 264.00	$1350.00	511
15.	Powder Metallurgy	$ 15.00	$ 44.00	293
16.	Physical Review Letters	$ 30.00	$ 270.00	900
17.	Science	$ 12.00	$ 65.00	541
18.	Scientific American	$ 10.00	$ 21.00	210
19.	Soviet Journal of Nuclear Physics	$ 85.00	$ 540.00	635
20.	Technological Forecasting & Social Change	$ 26.00	$ 136.00	523
21.	World Textile Abstracts	$ 70.00	$ 225.00	321

Source : Ulritch's International Periodical Directory.

INSDOC UNION CATALOGUE SERIES

1. Catalogue of Serials in the National Science Library, Delhi, October 1965

2. Catalogue of Serials in the Indian Institute of Science, Library, Bangalore, January 1966.

3. Catalogue of Serials in the Indian Statistical Institute Library, Calcutta, August 1966

4. Catalogue of Serials in the Indian Agricultural Research Institute Library, Delhi, March 1967

5. Regional Union Catalogue of Scientific Serials: Bangalore, June 1967

6. Regional Union Catalogue of the Scientific Serials: Delhi Medical Libraries, November 1967.

7. Regional Union Catalogue of Scientific Serials: Varanasi, June 1968

8. Regional Union Catalogue of Scientific Serials: Mysore, September 1968

9. Catalogue of Serials in the National Institute of Sciences of India, Delhi, October 1968.

10. Regional Union Catalogue of Scientific Serials: Kerala, May 1969

11. Union Catalogue of Serials in the Geological Survey of India Libraries, July 1969.

12. Regional Union Catalogue of Scientific Serials: Dehra Dun - Roorkee, February 1971.

13. Regional Union Catalogue of Scientific Serials: Bombay - Poona, April 1973

14. Regional Union Catalogue of Scientific Serials: Madras, Febraary 1975

15. Regional Union Catalogue of Scientific Serials: Hydrabad, December 1975

16. Regional Union Catalogue of Scientific Serials: Lucknow, Febraury 1976.

17. Regional Union Catalogue of Scientific Serials: West Bengal, June 1978.

18. Union List of Current Scientific Serials in India: December 1981.

IFLA
1985

Division: Special Libraries

Section: Science and Technology Libraries

9-SCIE-3-E

Information and Technology Transfer to Developing Countries

by

James E. Beverly
Associate Director for Information Services
Water and Sanitation for Health (WASH) Project
Office of Health
Bureau for Science and Technology
U. S. Agency for International Development
Washington, D.C. 20523

KEYWORD(S):

Information transfer
Technology transfer
Developing countries
Problem solving

For internal use only:

To be brought to meeting no:
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Remarks:
to be presented orally [*]
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(Abstract)

Information and Technology Transfer

To Developing Countries

The technology transfer process involves the movement of three elements: information, know-how, and "hardware" - the physical embodiment of a device that is used to do work or to provide a service. Each element has different properties and is transferred using distinct methodologies that have unique information requirements.

Several flow charts illustrate the complexity of the technology transfer process, but major emphasis in the paper is placed on the key role of information in the problem-solving process, of which technology transfer is a special case.

The five basic action steps used in problem solving and technology transfer are Diagnosis, Design of Problem Solution Strategy, Acquisition of Information, Analysis of Information, and Adaptation and Application of Information to solve the problem or transfer the technology. Each step is discussed briefly and the danger of sub-optimization of information acquisition beyond available human capabilities to analyze and apply it is stressed.

Information and Technology Transfer to Developing Countries

INTRODUCTION

The United States Agency for International Development (AID) has operational responsibility for implementing the U.S. development assistance program in over 70 countries. To focus AID's efforts, its administrator, Mr. Peter McPherson, has identified four key development pillars: 1) encouragement of sound host country economic and social policies at all levels -- macroeconomic, sectoral, and microeconomic; 2) emphasis on the private sector to support the growth of productive, self-sustaining, income- and job-producing private sectors in developing countries; 3) fostering institution building to enhance countries' abilities to marshall human and financial resources to ensure that development will continue long after assistance ends; and 4) promoting the creation, transfer and adaptation of technology and assisting countries to become capable of developing and applying a continuous stream of innovations that increase productivity, employment, and incomes.(1)

The cutting edge of AID's technology development and transfer activities is the Bureau for Science and Technology. Within it is the Office of Health whose Division of Water Supply and Sanitation sponsors the WASH Project -- Water and Sanitation for Health. The WASH contract operation provides AID's Bureaus and 73 overseas Missions and Offices with a broad range of short-term technical assistance services, including information support from its specialized library. Since 1980, the library's micro-computerized catalog has grown to 4,000 documents and additionally includes 80 country boxes of country-specific water supply, sanitation and environmental health related reports, maps, data, etc. The WASH Operations Center serves as AID's focal point for quick response support to AID Missions, disaster situations, local host country governments, private voluntary organizations, U.S. agencies, and organizations in the AID-assisted developing countries. WASH also collaborates with international organizations and is an active participant in the United Nation's International Drinking Water Supply and Sanitation Decade (1981-1990).

In support of AID's development pillars, one of WASH's major functions is the transfer of technology. The details of this complicated process cannot be

expounded upon in this paper; rather we will explore the role of information transfer as a key element in technology transfer, considered generically as a problem-solving process. But first we must consider what is meant by the term "technology."

Four Categories of Technology

Jacques Ellul, the contemporary French professor of law, theologian and philosopher-critic, has written extensively on the impact technology has on the western world. In his recent book, The Technological System, he states that

> "the entire field of activity, of human life, is the object of technologies. According to their application areas, we can divide these technologies into: mechanical technologies (a very wide term, also covering things that are not, strictly speaking, mechanical, like computers); economic technologies (for research and intervention); organizational technologies (for all types of social organisms, including government, administration, etc.); and 'human' technologies (for the individual or for noninstitutionalized groups, advertising, propaganda, group dynamics, psychoanalysis, etc.)."(2)

From Professor Ellul's view, we can see that "technology" is not a homogeneous concept. It really has has three major components: hardware, information, and know-how. Ellul's "mechanical technologies" include hardware; his other three categories of technology include only information and know-how. They are intimately related and all three are necessary for any technology to be designed, made, installed, used, maintained, or transferred. Hardware is the physical embodiment of a tool, device, material, part, or system that is used to do work or to provide a service. Information is written, verbal, or graphic descriptions, designs, specifications, procedures, and methods about all aspects of making, using, maintaining, operating, training, financing, and administering technology. Know-how is the skilled use of information and interpersonal relations to identify and solve problems. Know-how combines hardware and software (information) to produce desired technical solutions.

A Definition of Technology Transfer

Given these diverse categories of technology, it is not surprising that transfer modes should be, and are, equally diverse. For the purposes of this

paper, it should be sufficient to consider "technology transfer" as the movement and use of a given technology, with or without adaptation, from one institutional or organizational setting to another. It may be from a laboratory to a manufacturing unit, from farm to farm, office to office, or from one country to another. While technology transfer at first may appear conceptually simple and straightforward, in practice, even within a single organization, it is often a lengthy, complex, and sometimes unsuccessful process.

The Complexity of the Technology Transfer Process

The following three charts illustrate this complexity. Each step, block or cell on the charts have a different set of information requirements. This fact is often unrecognized or ignored with devastating consequences. The first chart is from a Unesco development study for the Arab States, and illustrates the "Interrelationships Between Horizontal and Vertical Technology Transfers and the National Planning process." The second chart is from the WASH Project of AID and lists the "Sequence for Technology Transfer Phases in Manufacturing and Marketing Water and Sanitation Devices in Developing Countries." Notice the important role that "software" plays in the sequence, software referring to the information and know-how aspects of technology. The third chart, also from WASH, identifies the major tasks and the task-execution responsibility of those concerned with the transfer and utilization of technology at the R&D, factory, and village levels in developing countries. It incorporates some features of the previous charts.

The charts show the various steps necessary to implement technology transfer at all levels -- from policy, planning, and conceptualization through research and development or acquisition to operational management of the transfer process and final utilization of the technology in production or in application by users or consumers. It has been emphasized that each step and each box in the charts has distinct information requirements, and each can be regarded as a separate, but related, information problem. The remainder of this paper will discuss the role of information in the problem-solving process, of which technology transfer is a special case.

Technology Transfers and the National Planning Process

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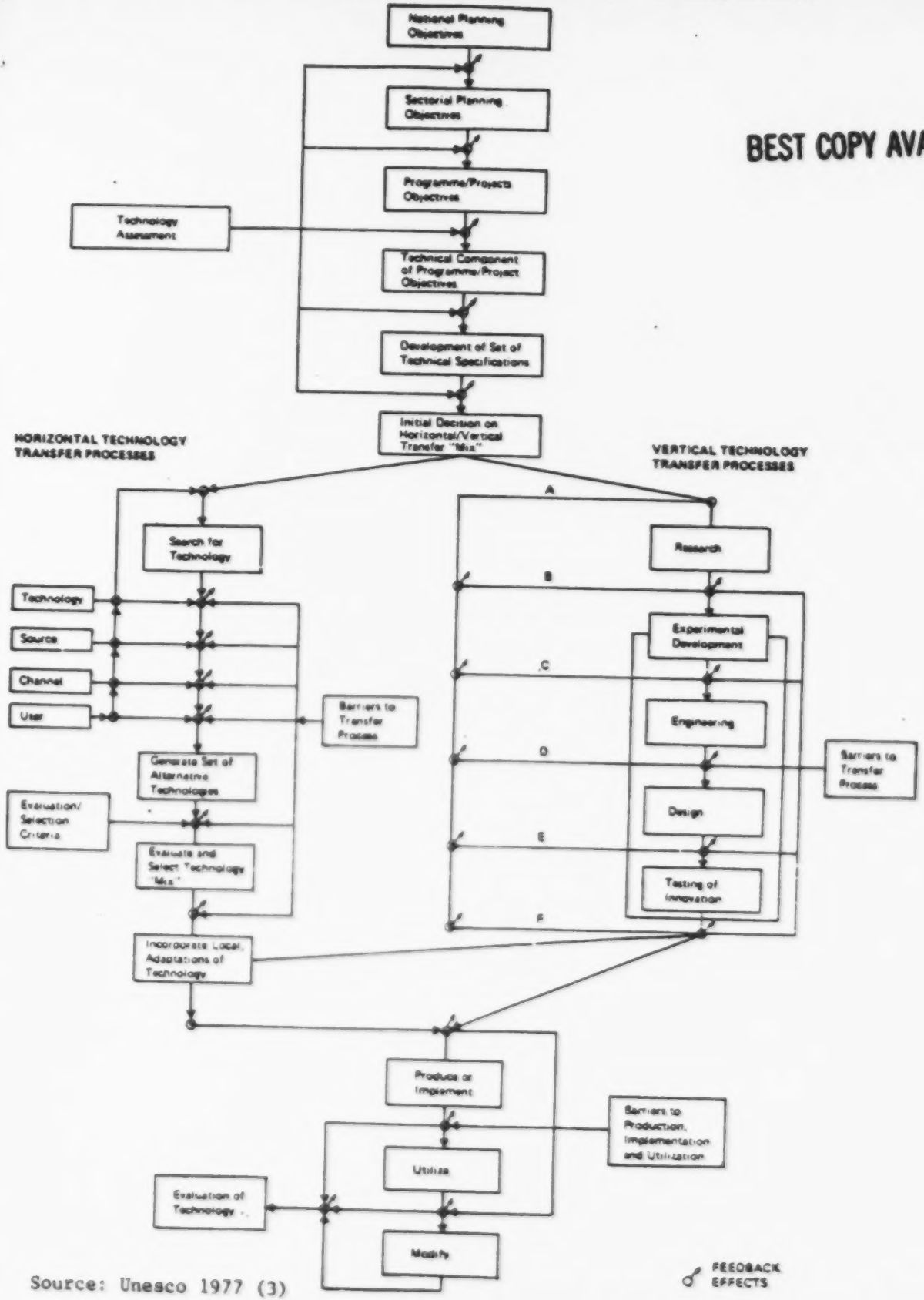

Source: Unesco 1977 (3)

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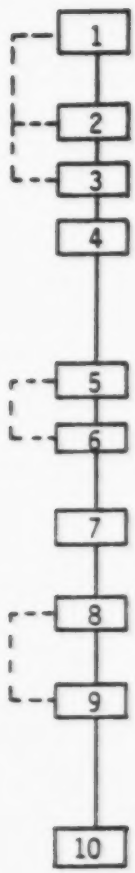
Chart 2. Sequence For Technology Transfer Phases In Manufacturing and Marketing Water and Sanitation Devices In Developing Countries



1. Concept of device to satisfy existing need
2. Working or lab models
3. Production prototypes
4. Software preparation for field testing: organization, finance, community education and participation, logistics, marketing planning, etc.
5. Field testing of hardware and software
6. Modification of hardware and software and retesting as required.
7. Preparation for first stage introductory production and marketing
8. First stage production and marketing
9. Evaluation of first stage introductory operations and their modification for second stage production and marketing
10. Second stage production and marketing

Solid lines are action flows
Dotted lines are illustrative information feedback flows to improve iterative actions

Phases may overlap in time

Source: WASH Project (AID) (1984) (4)

Chart 3. TECHNOLOGY TRANSFER AND UTILIZATION MATRIX

MAJOR TASKS	TASK EXECUTION RESPONSIBILITY										
	AID	WASH		PVO	Government			Local Business	Village/ Community	Other	Remarks
		Staff	Cons		Natl	Reg	Local				
1. Need/Demand Assessment for WS&S Systems/Services											
2. Technology/System Selection											
3. Sourcing of Technology											
3.1. R&D											
3.2. Purchase											
3.3. Local Mfg.											
3.4. Field Fabrication											
3.5. Logistics											
4. Village Operations											
4.1. Organization											
4.2. Supply											
4.3 Training											
4.4. Fabrication											
4.5. Installation											
4.6. O & M											
4.7. Evaluation											
5. Planning											
5.1. Overall Program/ Project Design											
5.2. Organization of Participants and Role Assignments											
5.3. Detailed Planning of Above 4 Phases											
5.4. Financial Planning											
5.5. Scheduling											
5.6. Evaluation Planning											
6. Evaluation											

Source: WASH Project (AID) (5)

The Role of Information in the Problem-Solving Process

1. The critical role of information in the problem solving process is illustrated in the diagram on the following page which includes six elements - the problem situation itself and five action steps:

    1. Diagnosis of Problem
    2. Design of Problem Solution Strategy
    3. Acquisition of Information
    4. Analysis of Information
    5. Adaptation and Application of Information

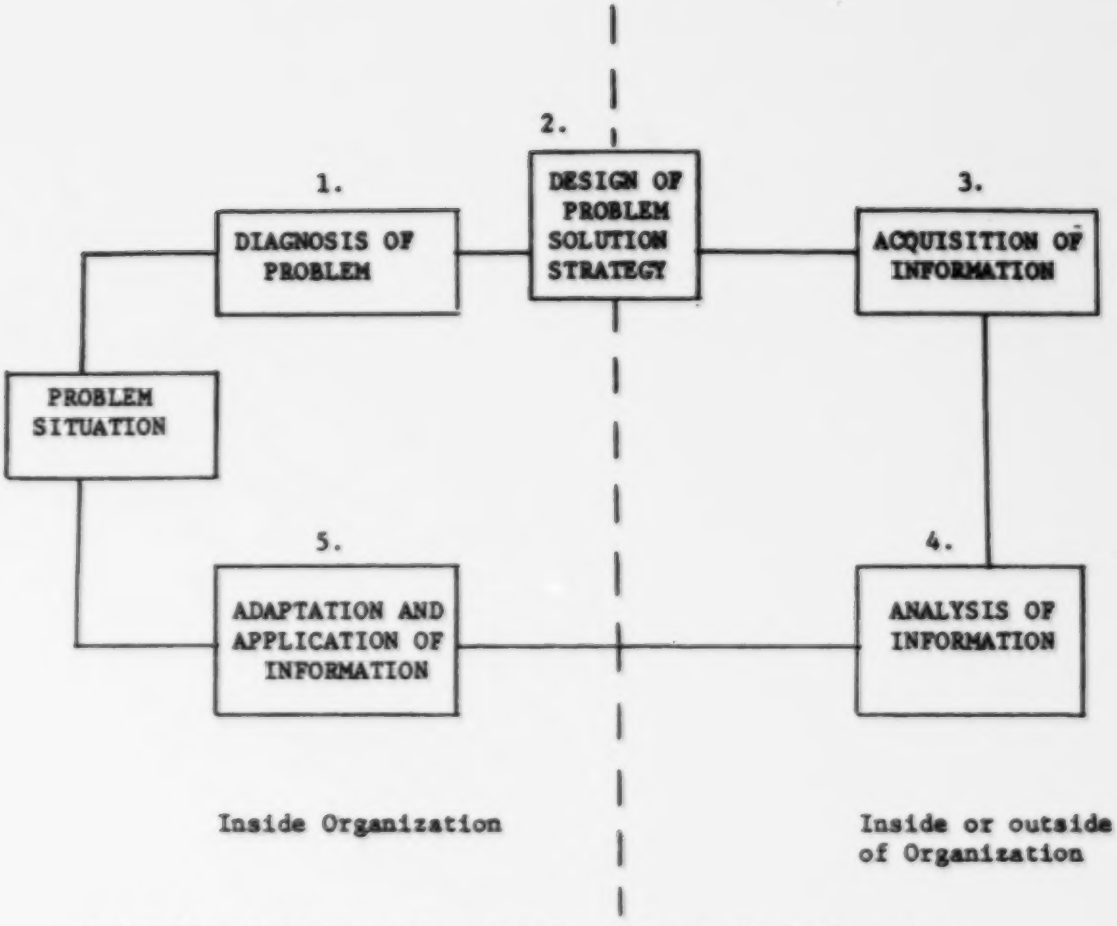
    Note: each of the five action steps in this chart apply to every block, phase and cell in the other charts on the technology transfer process.

2. The line which connects the six elements indicates the flow of problem-solving information in both directions on an iterative basis as required until the problem is solved. The vertical line indicates a possible organizational boundary. Depending on the size, staffing, and resources of an organization, the five action steps may take place within the organization, or steps 2, 3, and 4 may be executed outside the organization through the use of consultants, advisory services, data banks, etc. Action steps 1 (Diagnosis) and 5 (Adaptation and application of information) must take place within the organizational problem situation context.

3. The sequence of action from diagnosis through adaptation and application of information to resolve a given problem situation requires different skills ("know-how") and involves different types of information in each step.

4. The correct diagnosis of a problem is the key element in the sequence. If the diagnosis is incorrect, all subsequent actions are irrelevant and wasted. You may have answers, but they won't help solve the problem at hand.

Chart 4. **ROLE OF INFORMATION IN THE PROBLEM SOLVING PROCESS**



Solid line indicates flow of information in both directions.

5. The development of diagnostic problem-solving skills requires education, training, and experience ("know-how") at all organizational levels -- mechanics, clerks, supervisors, managers, and policy-makers. And at each level and for each problem, the diagnostician brings a distinct store of knowledge (information) to bear on the situation. It should be noted that the kind of information needed to properly diagnose a problem situation may be quite different from the kind of information needed to design a problem solution strategy.

6. Once the problem has been clearly identified in its situational context, one proceeds to Step 2: Design of Problem Solution Strategy. This step generates alternative approaches to information acquisition and to solving the problem consistent with the overall problem situation -- objectives, resource availabilities, constraints, time-frames, assumptions, etc.

7. In the course of designing the problem solution strategy, it may be necessary to reconsider the diagnosis and to reappraise the problem, as well as the situation, which may have changed. Such a reiteration may be required several times before the final strategy is determined, as indicated by the bi-directional flow of information in the diagram.

8. The person who designs the problem solution strategy may or may not be the same one who did the diagnosis and may or may not be inside the organization having the problem. And he depends on a different set of skills and information than the diagnostician. He must know <u>how</u> to solve the problem; <u>what</u> solutions are relevant, feasible, and appropriate; <u>what</u> specific information is required; <u>where</u> to go for it; and <u>how</u> to get it. After all, you do not want to suggest searching for an $800,000 process if only $100,000 is available for investment, or to encourage methods for manufacturing a $5.00 product when the competitive price is $2.00. This step also identifies, directly or indirectly, the informational needs. This brings us to Step 3: Acquisition of Information.

9. Large organizations often have the information required to solve a specific problem available from their own files, records, drawings,

catalogs, data banks, patents, libraries, or information centers. Smaller organizations may have a few directories, catalogs, abstract journals, indexes and technical journals, along with a small collection of documents related to their field of work. While these may or may not contain a solution to the problem, they may provide an indication as to where such information may be, what form it is in, who has it, and who could be contacted to acquire it. The smallest organizations (and countries) often must go outside to acquire the information they need to solve their problems.

10. Given the exponential growth of scientific and technical information (STI) over recent decades, a large number of abstract and index journals have come into being in all fields of S&T to assist in locating potentially useful information. Many of these journals are available in microform (micro-fiche and micro-film) and computer tape form besides their usual paper format. In addition, specialized services ("data banks") now have available, via telecommunication channels, literally millions of references, titles, and abstracts of STI. Europe, North America, South America, Asia, and the Near East are now linked by cable, satellite, micro-wave, and land lines to make the acquisition of STI an instantaneous reality by telephone, telex, modem, and/or video terminal at your desk.

11. As powerful and complete as many such systems are, for many organizations they create their own kind of special problem -- they make the acquisition of STI too easy and too quick (albeit not too cheap). What happens is that too much information is acquired -- more information than can be properly analyzed in relation to the capabilities and problem at hand. A good librarian in a fair sized information center, with or without access to a "data bank," can generate more STI material than can be digested and analyzed by a competent engineer, economist, or agronomist in a reasonable length of time.

12. This takes us back to the design of the problem solution strategy. If the information requested to solve the problem is not specific or precise, if it is general or vague, it may cause the acquisition of an excess of

information. Rather than having only twenty abstracts or reports to analyze, a poorly phrased question may generate fifty or one hundred and fifty documents. If the wrong problem was diagnosed in the first place, you can see how wasteful and confusing the process can become.

13. There are two lessons here: first, to be very careful in the diagnosis and the design of the problem solution strategy and the phrasing of the information request; and second, to avoid over-loading the analytical capacities of the individuals and organizations concerned.

14. Which brings us to the last action step in the problem solving sequence: adaptation and application of information to resolve the problem situation. This requires a special and relatively rare set of skills ("know-how"). The prior steps of information acquisition and analysis can be considered "academic" or "theoretical" because they only involve dealing with words and concepts separated from the reality of the problem situation. The adaptation and application step is pragmatic in that it attempts to put information to work in the field, in the face of a specific problem, and tries to solve that problem. In the application of information, we relate and connect information with reality. The quality, relevance, and completeness of the solution cannot be better than the information supplied and the skills of the person who uses it.

15. To summarize the problem solving sequence illustrated above: Step I, Diagnosis, involves perception and cognition of the operational realities of a given problem and its context. Step 2, Design of Problem Solution Strategy, generates alternative approaches to solving the problem. This step also identifies the kinds of information needed to solve a problem or on which to base decisions. Step 3, Information Acquisition, can be straightforward and direct, or may involve the use of data banks and extensive literature and patent searches. Step 4, Information Analysis, is as simple or as complex as the problem situation, and the content and scope of the information (solutions) assembled. The Adaptation and Application of Information, Step 5, evaluates and fits the proper alternative or data to the realities of the problem situation, and creates the synthesis and solution desired. It is significant to note

that Steps 1 and 5 require intimate, first-hand knowledge of the problem situation. Step 5 must be implemented within the problem situation or the organizational context that generated the problem. Steps 3 and 4, on the other hand, can be considered as "second order abstractions" and can be implemented anywhere, either inside or outside of the organization, depending on the availability of resources, qualified personnel, and communication linkages.

16. The information flows involved in the problem solving sequence present very real dangers of sub-optimization within the information system. Given the rapidly expanding volume of scientific and technical information, which is being paralleled by the development of large scale data banks and automated information retrieval and dissemination services, it is now relatively easy to drown people in a flood of information. More information can be acquired than can be properly analyzed and effectively applied. The trap of sub-optimization of information acquisition (Step 3) must be avoided, since the basic objective of information systems is to solve problems by applying (Step 5) the appropriate information derived from the analysis (Step 4).

17. A final observation: The effective and proper use of information is neither simple, nor obvious, nor widely practiced. Good information is necessary for sound decision making. But, if the decision-making process itself is not well organized and understood by all concerned, even the best information will not be able to play its vital problem solving role.

To summarize, we may say that the technology transfer process includes three kinds of transfer problems:

- transfer of information,
- transfer of know-how, and
- transfer of hardware.

Each transfer problem has a different content and requires different methodologies that must be carefully integrated in the overall process. Technology transfer begins with the acquisition and transfer of information, either from the supply (production) side, or from the demand (user or market)

side. The transfer of know-how, skills, and application information is necessary to establish production, marketing, utilization, and problem-solving capability in the individuals and institutions in the receiving country. Transfer of know-how is also necessary to create understanding, acceptance, motivation and effective operation and maintenance capability in the users of the hardware. Information and know-how are then used to adapt, transfer, make, market, use and maintain the hardware in completing the technology transfer process. Information and know-how can be considered the software side of the technology transfer equation with hardware on the other side. Both sides must be carefully coordinated and integrated if the technology transfer is to be successful over the long-term life-cycle of the hardware, institutions, and markets involved.

The Chinese have a proverb that provides a fitting close to this discussion:

> If you are planning for a year, sow rice,
> If you are planning for a decade, plant trees,
> If you are planning for a lifetime, educate a person.

It is hoped tha this paper will contribute to education in the complex process of transferring information, know-how and technology to developing countries.

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The Domesday Project

An Innovative Use of Optical Disc Technology by the British Broadcasting Corporation

by

Peter Armstrong, Editor

The Domesday Project

BBC TV - Bilton House

54-58 Uxbridge Road

London W5 2ST

England

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[ABSTRACT]

The Domesday Project

An Innovative Use of Optical Disc Technology

by the British Broadcasting Corporation

Peter Armstrong

1986 will represent the 900th anniversary of the Domesday Book, the record of a survey of English lands made by order of William the Conqueror. To mark this anniversary, a 1986 Domesday Project is being produced by the British Broadcasting Corporation (BBC) to create a contemporary survey of Britain--in pictures, in text, and in data--intended to cover a particularly important decade of social change.

Optical disc technology will play a major role in the Domesday Project as the large amounts of data are collected and collated from communities all over Britain. The material will be published on two interactive optical laservision discs. The BBC and Philips laboratories in Eindhoven are working to develop a new format for a disc on which still images and digital data may be combined at a cost that is marketable to libraries, Government departments, and corporations. The information will include demographic data, social survey data, Government statistics, and environmenal data that, when illustrated with pictures, diagrams and maps in a display form, will provide a technologically advanced presentation more vivid and dynamic to the user.

Described in this paper are important issues of costly updating of information, competition in the emerging technologies market, copyright, and the place BBC should take in this new era.

The Domesday Project

An Innovative Use of Optical Disc Technology by the British Broadcasting Corporation

Peter Armstrong

What is the Domesday Project?

Next year is the 900th anniversary of the best known national survey of England - the Domesday Book - which was completed in 1086 at the order of William the Conqueror, who wanted to take stock, literally take stock, of the new kingdom he had acquired.

As a television producer involved in making programmes to mark that anniversary, I had the idea of in fact creating a new Domesday Book - I thought that would be more fun than just making films about the last one - and to make use of the one most important advantage we have over William the Conqueror, which is obviously the computer. The aim of the Domesday Project then, is to produce a new, contemporary snapshot in pictures, in text and in data of Britain in a particularly important decade of social change. A snapshot that could be valuable as a mirror to ourselves, particularly in the educational community, and also have potential as an archive for future generations looking back

at the 1980s.

I looked first at the possibility of using large central mainframes to collect this new data, but then realised that a more powerful computer resource was the hundreds of thousands of micros already distributed throughout the community - especially in schools. If they could be put together into an ad-hoc network, it seemed possible that we could get an amazing collection of data coming back to the centre. The idea was that in this way, the portrait of Britain that we would be assembling would be painted by the people themselves - we began to call it a 'people's database'. So we invited schools to take part via a special television programme and a mass mailing, and we have been overwhelmed by the response. We have some 14,000 schools as well as many other groups who have volunteered to survey their local area. We sent out survey guides; we sent out floppy discs with data collection software to all these groups, and during the summer term this year throughout the length and breadth of Britain, there have been about a million adults and children hard at work, collecting data on such things as landuse, social amenities. They are taking local photographs and they are writing in their own words 20 pages of text which express something of the life of their community as they see it in 1985. In turn they have mobilised local communities to help them in a

quite extraordinary way and at times we wonder just what we have unleashed.

Now, how will we publish the resulting information next year when it's all been collated? On two interactive optical laservision discs. I believe that the interactive videodisc is the most exciting development in the field of public information and of non-broadcast programme making. In Britain it has however suffered some limitations which have restricted its use and we are hoping to circumvent these by developing a new format of disc together with Philips in Eindhoven.

The first difference will be that we shall be combining on a single disc, the 110,000 still images with an additional 640 megabytes of digital data. This in turn makes possible the kind of sophisticated indexing which friendly retrieval software will need to make use of such a large picture and database, once the player is attached to a micro. Finally, we hope to achieve this at a significantly lower price than the present professional videodisc systems bringing it, if possible, below the 1,000-pound mark, so that it becomes available to schools and even to certain individuals, as well as to our main market which is libraries, Government departments, corporations and so on.

What will be on the discs?

The first of the two discs, we are calling the community disc. It will be a gazetteer of Britain in the 1980s, based on 20,000 ordnance survey maps of every part of the kingdom at three scales. You will be able to move around Britain on the maps, and then behind any map as it were, drop through to the relevant photographs and text about the place that interests you: text, you remember, written by the people who live there. To a certain extent it's soft data, it's not checked at source, it's anecdotal, and yet particularly for future generations looking back I think its very colour may be its attractiveness. Perhaps more relevant to this conference is the second disc. In this we shall present what you might call the official view of Britain in the 1980s, drawn from the big Government and academic databanks. To decide what should be included on this disc, we have set up an Editorial Board, independent of the BBC, of distinguished academics, social scientists, economists, environmentalists, geographers, social historians as well as members of the civil service concerned with statistical provision. The kinds of data they are subsetting for the disc are, to give a few examples: Demographic data from the 1981 census. We are hoping to be able to include some 200 variables and to be able to adjust them to a 1 km resolution.

Social survey data, whether from big Government datasets like the General Household survey, or from sample survey results on attitudes or behavior. Thirdly, Government administrative statistics ranging from something like farming returns to the macro-economic data bank. Fourthly, environmental data which ranges from soil survey data to biological records showing, for example, distribution of species. But as important as the collecting of the most interesting data sets is the finding of the most interesting ways to display them. We are obviously illustrating with pictures, with diagrams and maps - that's the advantage of having a video-disc - but even with the statistics themselves we can achieve, we hope, a form of presentation much more dynamic than in the printed medium. Thus, for example, a map is not static, you can zoom in, you can zoom out, and you can overlay it with a number of different variables relevant to the topographic background: the distribution, for example, of endangered species, the pattern of landuse, the incidence of certain amenities, market opportunities, the pattern of social deprivation, whatever it might be. Again, simple statistical tables which are often obscure to ordinary people can be made not only more vivid in display form, but interactive so that they change in response to the questions that the user puts.

Little in the data itself is new. What we are trying to do is

make it available to ordinary people via a friendly and powerful retrieval software and to make it available in a form that is vivid and easy to understand. And finally to make it interactive so that we are at least taking the first step towards the expert systems of the future. I am sorry there are no examples to show at this moment - there won't be even prototype examples until the end of this year, but from our preliminary trials it seems that even quite hardened data professionals get quite excited at the possibilities opened up by this form of visual interactive display.

Finally I'd like to raise one or two issues that seem to me to arise from this project:

The first is the question of how volatile is this kind of database. It's costing us about 3 million pounds to produce, so it's clearly unlikely that we shall decide to update it annually. Could it then be partially updated, for example, with a re-pressing of the disc with only statistical data change. Or could corrections to the data be sold on compact disc or on line or through some broadcast teletext system. There are all kinds of possibilities there and until we can get some kind of market feedback to the first part of the project we won't be sure which way to move, but the issue of updating is a crucial one.

Secondly, it's far from clear at the moment, as you must be aware, of what world standards will emerge from the present plethora of developments in the optical recording, field and we have in fact confused the situation further by announcing a new type - the combined analogue and digital disc. We've done so in order to increase the number of broadcast quality pictures on the disc by a factor of about 10. But we are aware that in doing so we are competing with a number of other emerging technologies, notably the digital compact disc, the on-line photo videotex system and the interactive cable delivery system. But by whatever means they arrive it does seem clear that large data-bases which include pictures will be available comparatively cheaply in the next few years beginning, as we see it, in schools and public libraries. I regard this as very positive development. It represents what I see as the democratisation of data: making available to people in the community the kinds of information that at present are easily available only to the decision makers in society. Much of this data has been collected, as it were, on behalf of the public and in theory it is in the public domain. But the public access and the public understanding have been limited by the way it has been stored, indexed and displayed.

The third issue is that of copyright. Many of these datasets are, as I have said, theoretically in the public domain but there has been a clear trend in the past few years in Britain to see such data in commercial terms. Indeed, recent Government reports have recommended this approach. In the case of the Domesday Project quite large sums of money have been mentioned for the use of some of these public datasets and this could prove an unsuperable barrier in the future to some of the exercises in data dissemination which I have described, if it is to be done by a non-commercial body like the BBC. To give another example, the real limitation of putting pictures onto a videodisc is not likely to be the technical limit of 100,000 pictures but the copyright limit.. The current cost of 100,000 pictures from agencies in Britain is 10 million pounds.

Fourthly, the Domesday Project raises the question of why a broadcasting authority like the BBC should become involved in this difficult world of new information technology. I believe that it's right that it should and that, indeed, such organisations are perhaps uniquely well placed to do so because we can combine under one corporate roof, some experience in picture archiving for both moving and still pictures, of data archiving to a lesser extent, of picture and data handling both of videotape and computer tape, of the design of new hardware configura-

tions and software support. And on top of all that some journalistic experience in how to package this material in a way which makes sense to the end user. We also, incidentally, have two channels of public television to act as a shop window for this kind of non-broadcast exercise. If the Domesday Project is judged a success at the end of next year then I think it could be just the beginning of a new era of electronic publishing for the BBC. At the BBC we certainly bring to the debate on how much data should be made available to the general public our own long tradition of public service broadcasting. We naturally therefore believe in broadcasting data, not restricting it to an elite who claim to be the only priesthood who can understand its mysteries.

As to the future, we expect to be able to offer the software and the hardware systems we have developed for Domesday to other countries who wish to undertake similar national projects. And we are also now embarking on plans for a set of Global videodiscs, the equivalent of the Domesday Project for the planet as a whole, and we are in the process at this moment of looking for international partners in such an undertaking. Again I see this as idealistic in the same sense as the Domesday Project as well as educational and commercial. I personally believe that the first step towards creating as grand a concept as "a better world" is to make more widely available a vivid data picture of

the present state of the world. By exploring emerging information technologies, we will, I hope, be following the traditions of the motto of the BBC, itself a very idealistic one, that "Nations shall speak peace unto nations."

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Optical Disks - An Emerging Technology For Libraries

William R. Nugent
Library of Congress

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Optical Disks - An Emerging Technology For Libraries

William R. Nugent
Library of Congress

Optical disks have one startling attribute, quite apart from the many technological advances they embody: in terms of the benefits they offer they appear to have been designed specifically for libraries.

That this was neither their historical developmental goal nor their chosen positioning in the marketplace is not important. What is important is the reality of these benefits and their direct applicability to libraries of all sizes. We will therefore begin our discussion with a description of these benefits in a library context; provide a brief review of the technical basis for these benefits, and then describe the principal forms of optical disks now in use. We will then conclude with a description of current and future applications of optical disks.

Throughout we will emphasize the fact that while optical storage is still an emerging high technology and one of the fastest moving technologies in terms of new developments, new company formations, and new product offerings, optical disk systems of high capability are available today which can be the basis for significant improvements in library operations and services. Today the optical disk industry is still in its infancy but it is an industry with explosive growthg potential and one whose market size is expected to reach 5.4 billion dollars by the end of this decade.

OPTICAL DISK BENEFITS IN LIBRARIES

One dominant characteristic of optical disks is their extremely high density of information storage. Optical disks offer the highest areal storage density available today, which density is in the order of 50 to 200 times greater than the high density magnetic disks currently used in major computer centers. Specifically, optical disks have recording densities in the range from about 250 million bits per square inch to more than 650 million bits per square inch, with 400 bits per square inch becoming common. This compares to 3 million bits per square inch for the familiar 3350-type magnetic disks and to 12 million bits per square inch for the newest 3380-type magnetic disks. High density is an important benefit by itself, but in addition leads to important reductions in both retrieval times and costs. We will explore these factors in a library context. As might be obvious, the extremely high density of optical disks can provide significant savings in library shelf space. What might not be

obvious is that such space reduction can be in the range of three orders of magnitude.

Optical Disks and Library Space Management

It is the nature of library collections to expand but library space and library facility budgets rarely exhibit a corresponding elesticity. Hence all libraries can be said to have a "space problem". Optical disks can shrink the space needed for growth. We will consider 12-inch diameter digital optical disks recorded on one side and stored in single cartridges, and contrast these with conventional hardbound printed monographs of, say, 300 6 by 9 inch pages.

Character-Encoded Information

For information recorded in character-encoded form wherein each character in the text is represented by an 8-bit binary code, a single 12-inch disk will store a billion such characters that is, one thousand million, or 10 EXP 9 characters. This is equivalent to the text of 1389 complete monographs. In hardbound printed form, these would take up about 126 feet of shelf space. The disk in its cartridge takes up about 5/8 inch, yielding a linear shelving reduction in the order of 2400 times. In practical terms we would have to allow for the taller height and greater depth of the disk cartridge (approximately 13 by 16 inches), but we would still have a shelving advantage factor close to 2000.

Digitized Image Information

The second means of storing text pages on optical disk is that of storing digitized page images. In this process the page is considered as a picture rather than as a succession of characters and words, and the page area is treated as a fine-mesh matrix, or array of cells, in which each cell is given a discrete value of black (part of a text character) or white (space). The number of bits per inch determines the resolution of the stored image and the fineness of detail which can be re-created. This number is also called lines per inch in recognition that the scanning generally takes place a scan line at a time down the page. Current scanning devices generally operate between 200 lines per inch and 400 lines per inch. 200 lines per inch is satisfactory for office correspondence and the body text of most printed matter; 300 lines per inch appears optimal in the sense that almost all printed matter can be resolved, including scientific text and mathematical text with small and hard-to-read superscripts and subscripts; and 400 lines per inch is becoming favored by Japanese firms for their domestic use with finely-detailed Japanese characters. The Library of Congress has elected 300 lines per inch for its page image applications, and this scan density enables perfect

storage and re-creation of matter as small as 4-point type. In an earlier optical disk project involving digitized images of catalog cards, the Library of Congress used 480 lines per inch in order to capture the smallest nuances of Chinese, Japanese, and Korean scripts.

For the typical 6 by 9 inch monograph page, a digitized page image takes about 25 times more storage than a corresponding character-encoded page, but a single 12-inch optical disk with a gigabyte (10 EXP 9 characters) of storage, as discussed above, will still hold about 55 complete 300-page monographs and provide a shelf-space reduction factor of about 80. This example exhibits a most important point about optical disks: for the first time we have a computer-accessible storage medium where it is both technically and economically feasible to store digitized image information. The recorded density of optical disks is such that 4 digitized book pages can be recorded on an area no bigger than the head of a pin.

The importance of page images becomes more apparent as we move from simple text-only monographs to serials such as scientific journals and news magazines where an adequate understanding of the articles requires the inclusion of tables, charts, graphs, mathematical formulae, graphic arts elements, and photographs. These are automatically included with the text when page images are stored and are totally lacking when only character-encoded text is stored. Thus digitized page images provide a more general and more comprehensive approach to information capture and, as we have seen, still provide considerable savings in library space.

Optical Disks and Library Reference Services

In terms of image area a digitized page image on optical disk takes about 1 percent of the corresponding image area on 16mm microfilm. But were extreme density the only characteristic of optical disks, we would merely have a successor technology to microfilm. However, because optical disks are designed to be accessed under computer control and because all readout is done with a reflected beam of light from a low power laser, we have a medium which , unlike microfilm, permits swift and precise computer access to any record in a vast store and a medium which, unlike microfilm or magnetic tape or floppy disks, does not deteriorate under coinditions of constant usage. We begin to see why optical disks are an ideal medium for library reference services.

Far more powerful than computer search of cataloging records, optical disks can provide the user with immediate access, via high resolution display screens, to the complete pages of the material wanted. This is the strongest benefit of optical disks - the substitution of high-speed electronic delivery of the actual information wanted for the slow manual processes of searching the shelves and delivering the desired

printed materials. In many large research libraries, computer search of the catalog can identify desired materials very swiftly. But the time between identification and physical delivery of the materials can extend to an hour in traditional systems.

Like any computer retrieval system, an optical disk retrieval system can serve many user terminals simultaneously. The difference in the case of retrieving digitized page images is the use of a high resolution display terminal capable of displaying a complete page of text, graphics, and pictorial matter, in easily readable form. In a typical installation the user is served from one or more "juke boxes", each holding in the order of 100 12-inch diameter optical disks. The juke box occupies a space equivalent to about 5 office file cabinets and can hold approximately 1 million digitized page images from journals or magazines, or about 2 million page images of text-only books pages, or about 16.6 billion words of character encoded text which is the equivalent of 387 copies of a 30-volume encyclopedia and more than 300 years worth of reading material if 8 hours per day were spent at the task. Optical disk juke boxes permit any record on any disk to be accessed in 10 to 15 seconds time. To insure that persistent readers do not cause delays in the system, materials requested by any one user terminal are buffered onto magnetic disk for terminal usage in 10 to 20 page batches thereby freeing the juke box for other users.

An additional benefit in library reference services is that the files are always fully intact and available for use. Even in the case of high usage current materials, items may be accessed by multiple users and are never in the "not on shelf" status that befalls many active library materials.

Reference Services in Pictorial Collections

The laser videodisc is a form of optical storage of use in accessing pictorial collections. Most often of 12-inch diameter, these discs store color television images in standard television format for viewing on standard color television receivers or monitors. In the most common form, one side of a videodisc can store 30 minutes of continuous motion picture material or 54,000 separate still frames or mixtures of the two. For fast access to library pictorial collections, the videodisc is unsurpassed. Any selected still frame may be accessed in 1 to 3 seconds time, and the same frame may be viewed all day if desired with no wear to the videodisc. Like the digital optical disk discussed previously, the videodisc is under computer control. In its most useful configuration, sometimes called "Level 3", the vidseodisc is controlled by a separate external microcomputer which accepts user search requests, searches a database of information about the pictures, and directs the videodisc player to the necessary frame locations which frames are then displayed. The laser videodisc is the highest quality

television storage medium in the consumer market. It delivers an image quality which is superior to both consumer grade 1/2 inch videotape and industrial-educational grade 3/4 inch videotape. Videodiscs are mastered on 1 inch broadcast grade videotapes and maintain this level of quality.

Unlike the digital optical disk system we discussed earlier where centralized juke boxes distributed data to remote terminals, the lower cost of elements in a videodisc system has encouraged the use of stand-alone workstations, the basic elements of which consist of a videodisc player, a microcomputer, and a color television monitor. More advanced workstations may include a graphics overlay system, a sound-over-still frame device or voice synthesizer, and a video output printer in color or black-and-white. Juke boxes do exist for videodiscs but their major application to date has been as juke boxes in the classic sense - that is for the coin-operated playing of popular music "videos" in commercial establishments.

For research in large pictorial collections, the videodisc offers a previously unavailable capability to perform high speed browsing and high speed random access retrieval of selected images. It provides an excellent means for libraries to make pictorial collections of rare or fragile materials available in surrogate form for public use and research.

Reference Services in Music Collections

The most popular form of optical storage is the Compact Disc Digital Audio System, or CD as it is usually called. Its characteristics make it particularly suited for libraries with music collections. It is almost certain to become the successor to the long playing record. Like the videodisc, it is a replicable optical disk, readily duplicated in large quantities by its manufacturer. Currently recorded on a single side, this 4.72 inch diameter disc can hold up to 72 minutes of digitally encoded music. Its quality in terms of frequency response, dynamic range, distortion, and noise level is unmatched by any consumer recording medium. Like all optical storage media, with reasonable care in handling it suffers no degradation from constant usage, making it a superior medium for circulation purposes as well.

Optical Disks and Library Preservation

Optical disks of current manufacture have a life expectancy in the order of 10 to 20 years, yet they have an important role in library preservation. This is not a contradiction and the reasons are different for the digital optical disk and the analog videodisc.

Like all computer storage media, digital optical disks are protected by error detection codes and error correction codes. Because of the nature of recording in the extremely high density of optical storage, particularly strong codes are used. Over time, as the disk material ages, an increase in correctable errors will take place prior to the occurence of uncorrectable errors. By monitoring this process, one will be able to make a perfect copy of an old disk when the increase of correctable errors is observed. Hence we have the digital equivalent of preservation, which is preservation of the information by successive rewrites as the media ages.

A second method suitable for replicable digital optical disks and for videodiscs is to preserve a metal plated stamping master.

Videodiscs present a challenge because they are an analog medium, and successive generations of an analog recording become successively worse. However, in library pictorial collections videodiscs can contribute to preservation in an indirect way. That is by offering a surrogate viewing of the collection on videodisc, the collection materials themselves are spared much handling and wear.

Longer lasting optical disks are evolving, however. Much of the current optical disk research being conducted is in improved recording materials, with particular emphasis on materials for erasable optical storage, and longer lifetimes are being reported (2). It is felt that the combination of newer optical recording materials with longer life expectancies along with automated programs of error testing and rewrite will make optical storage a desirable preservation medium.

THE TECHNOLOGY AND FORMS OF OPTICAL STORAGE

We will briefly address the basic technology of optical storage which makes possible the benefits we have described. There are many forms of optical storage but these forms are more alike than different as we shall see. Optical recording consists of using a finely focussed laser to make an "effect" occur on a thin, most often metallic, sensitive recording layer. This effect can be a bump, a bubble, a micro-volcano in the case of ablative recording, or any other process which will change the reflectivity of the surface at that point. "That point" is a very small point indeed, generally in the order of 1 micron or so. Lasers generate coherent light, light in which all emitted

waves travel in step, and operate at one specific wavelength. Formally, optical storage consists of recording at the wavelength of light which accounts for its small dimensionality. The visible spectrum has wavelengths between 0.4 micron (deep violet) to 0.7 micron (deep red). Most current optical disk systems use diode lasers because of their small size, and these tend to operate in the near-infrared region at a wavelength of about 0.82 micron. Writing an optical disk consists of changing the reflectivity of the recording layer selectively, and reading is accomplished by measuring this reflectivity.

For all writable optical disks, the recording laser operates on a thin recording layer. For replicable optical disks the original recording is done to a photoresist surface from which a stamping master is made. For analog disks, such as the videodisc, variable length "pits" define the FM encoding of the television signal. For digital disks, fixed length "bits" are generally encoded, though this can vary depending on the modulation method chosen. Through various coding methods, an analog videodisc can be made to carry digital data, as in the disks of LaserData and Reference Technology. Similarly a digital disk can be made to carry analog information, as in the Philips/Sony CD music system. Several other varieties of optical storage exist but have not achieved any market of consequence. The four basic forms are those we have discussed: digital, analog, digitally encoded analog, and analog encoded digital.

CURRENT AND FUTURE LIBRARY APPLICATIONS OF OPTICAL DISKS

We have seen principal applications of optical disks in libraries in the retrieval of text, page images, and pictures, and in the playback of digitized music. We have not mentioned Library of Congress applications in great detail, as this has been treated extensively in the literature (3),(4),(5),(6),(7),(8).

Four new developments in optical storage will expand the scope of these applications considerably.

First, already on the market, is the Compact Disk Read Only Memory or CD ROM. When used as data source for microcomputers these will provide the microcomputer user with an entirely new capability - the capability to access massive data bases without paying communications costs or service bureaus. The CD ROM is an electronic publication medium and will amplify the power of small computers. Libraries will acquire published CD ROMS as they do books and will find many reference uses for them.

Second, coming by the end of this year, is the new series of 5 1/4 inch write-once optical disk drives and disks, also designed as low cost microcomputer peripherals. This will permit the microcomputer user to build his own large data base at low cost. Initial units will be in the 100 megabyte range compared

to the CD ROM's 540 megabytes, but capacities will rise and this and the CD ROM will both become necessary peripherals for information workers with microcomputers.

Third, early next year we should begin to see 5 1/4 inch erasable optical disks using magneto optical technology, and a year later other sizes should begin to be available including, perhaps in early 1987, a 14 inch format erasable optical disk for computer room usage. At that point the conventional magnetic disk will give way to optical disk for large scale computer room applications. The 5 1/4 erasable disk will sweep aside the "hard disks" in the 5 to 50 megabyte range now popular with microcomputer users.

Fourth, we expect an October 1985 introduction of the first high definition television (HDTV) videodisc. Because of its much higher resolution (1125 lines rather than 525) this will expand the applications for videodisc access to visual materials in libraries, and the HDTV system itself stands a fair chance of becoming the first international standard for television.

We started by describing systems for storing page images of text and have concluded by mentioning the HDTV videodisc for images of visual materials. Increasingly, the trend is towards greater use of image materials on optical storage under computer control. We have called this field Image Automation - the acquisition, storage, processing, and retrieval of image information - and predict that it will become a major growth area during the coming decade and one of high significance to libraries.

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